B056814

NASA TECHNICAL NOTE

NASA TN D-2359

NASA TN D-2359

THE EFFECTS OF COMBINED PRIOR STRESS AND ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS

by Robert A. Leybold

Langley Research Center
Langley Station, Hampton, Va.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • AUGUST 1964

9-4-64 Have not - MR
10-23-64 " "

56814
typ.

Mary J.

ERRATA

NASA Technical Note D-2359

THE EFFECTS OF COMBINED PRIOR STRESS AND ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS

By Herbert A. Leybold
August 1964

The attached corrected cover for this Technical Note should replace the original cover on which the author's first name is incorrect.

THE EFFECTS OF COMBINED PRIOR STRESS AND ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS

By Herbert A. Leybold

Langley Research Center
Langley Station, Hampton, Va.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

For sale by the Office of Technical Services, Department of Commerce,
Washington, D.C. 20230 -- Price $0.50

THE EFFECTS OF COMBINED PRIOR STRESS AND ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS

By Herbert A. Leybold
Langley Research Center

SUMMARY

Fatigue tests were conducted on 300 vibrating cantilever sheet bending specimens after the specimens were subjected to atmospheric stress corrosion for varying periods of time up to 4 years. Specimens of 2024-T3 and 7075-T6 aluminum alloy in both the bare and clad forms were tested. For comparison, companion tests were conducted indoors. The results indicate that the constant stresses applied to the specimens during the stress-corrosion portion of the investigation had no significant effect on the fatigue life. Most of the reduction in fatigue life due to atmospheric exposure occurred during the first year. The fatigue lives of 7075-T6 and 2024-T3 specimens in the bare condition were shortened by factors of 4.0 and 3.5, respectively, while the life of the 7075-T6 material in the clad condition was shortened by a factor of 1.5. No factor could be determined for the 2024-T3 clad material because of the scatter of the test results.

INTRODUCTION

Aircraft are exposed to atmospheric corrodents almost continuously during their service lives. In the normal service life of 15 or 20 years, the aircraft is on the ground approximately 2/3 of the time and is in a statically stressed condition while being exposed to the atmosphere. During the remainder of the time the aircraft is airborne and is subjected to the simultaneous action of atmospheric corrodents and fatigue loading. Most of the fatigue testing of aircraft structural materials is done under conditions which prevent serious corrosion. When corrosion is included in the fatigue evaluation, artificial corrosive agents are usually used and the tests are conducted at an accelerated rate. Reference 1 provides an evaluation of the atmospheric corrosion fatigue life of aircraft structural materials under conditions which are more nearly representative of the actual operating conditions of an aircraft. Still to be determined is the interrelationship between stress corrosion and fatigue. Numerous stress-corrosion experiments have been performed under both atmospheric and artificial environments but no relationship between stress-corrosion and fatigue has been established for aircraft structural materials. The present investigation is intended to evaluate the fatigue life of aircraft structural materials which have been subjected to a stress-corrosion environment prior to fatigue testing.

Tests were conducted under the atmospheric conditions prevalent at the NASA Langley Research Center which is located near the Atlantic seacoast. Sheet bending specimens were exposed to the atmosphere for periods of time up to 4 years while loaded at three different constant-stress levels. Periodically, specimens were taken indoors and tested to determine their fatigue lives. These lives are compared with the lives of previously unstressed specimens which were stored indoors.

The units used for the physical quantities defined in this paper are given both in the U.S. Customary units and in the International System of Units (SI) (ref. 2). An appendix is included for the purpose of explaining the relationships between these two systems of units.

TESTS

Specimens

The specimens were made of 2024-T3 and 7075-T6 aluminum-alloy sheet in both the bare and clad forms and were nominally 0.051 inch (1.3 mm) thick. The average tensile properties of the materials tested are listed in table 1. These are the same data as those reported in reference 1; the same lot of material was used for both investigations.

Vibrating cantilever sheet bending specimens were machined to the configuration shown in figure 1. The dashed lines in figure 1, radiating from the point of load application, indicate the shape of a constant-stress cantilever. Maximum bending stress occurs in the section at which these lines become tangent to the boundary of the specimen. A 1/4-inch- (6.4 mm) diameter hole was drilled and reamed in this cross section of each specimen to introduce a stress concentration. The edges of the specimens were carefully machined and burrs were removed with fine emery cloth. Each specimen was measured at the critical section for thickness and net width to an accuracy of 0.0001 of an inch (2.54 μm). The theoretical stress-concentration factor for specimens of this configuration loaded in bending is equal to 1.6 (ref. 3).

Test Apparatus

The specimens were clamped to a wide flange beam as shown in figure 2 and exposed to the atmosphere. Several beams were used to accommodate the 300 specimens tested. The beams were located in an open area and positioned so that no shadows were cast on them except in late afternoon. Plastic shims sandwiched the specimens between the clamping block and beam in order to prevent galvanic action at this point. The specimens were stressed to the desired stress levels with the aid of a T-section at the tip of the specimen, a piece of aluminum wire and a threaded eye bolt (fig. 2). The eye bolts were secured with two nuts on the top and bottom of a 1/4-inch- (6.4 mm) thick piece of steel plate welded to the underside of the beam. Once deflected to a position corresponding to the desired stress at the critical section of the specimen, no further adjustments were made. Upon removal from the beams, the specimens were fatigue tested indoors in a sheet-bending fatigue-testing machine (ref. 4) at a frequency of 1800 cpm (30 Hz).

Procedure

The loads required to produce the desired stresses in the specimens were computed with the flexure formula by using the measurements taken at the critical section of each specimen. These loads were then applied statically to the specimens to determine the deflections for the desired stress levels. Nominal net section stresses of 0, 12 (83), and 30 ksi (206 MN/m^2) were used in the stress-corrosion portion of this investigation. The fatigue stresses applied to the specimens in the laboratory after the desired exposure period were the same as those used in reference 1, and are as follows: 12 ± 25 ksi (83 ± 172 MN/m^2) in the bare specimens of both alloys; 12 ± 14.5 ksi (83 ± 100 MN/m^2) in the 7075-T6 clad specimens, and 12 ± 15 ksi (83 ± 103 MN/m^2) in the 2024-T3 clad specimens.

The specimens were stressed and exposed to the atmosphere beginning in January 1959. Five specimens of each material and each stress level (a total of 60 specimens) were removed after each of the exposure times of 1/2, 1, 2, 3, and 4 years and were fatigue tested indoors at the aforementioned stresses. For comparison, five unexposed and unstressed specimens of each of the four materials were fatigue tested at the end of the 4-year period at the same stress levels.

Meteorological data for the duration of these tests were obtained from the NASA Weather Station at Langley Field, Virginia, and are summarized in table 2. It rained on approximately 50 percent of the days that specimens were exposed, and on many mornings there was a heavy dew on the specimens. It is reasonable to assume that on many days the air contained a fair amount of salt, since the test site was situated near the seacoast. Thus, the test environment probably was as severe as the environment encountered by many aircraft.

RESULTS AND DISCUSSION

The number of cycles required to produce failure in each of the specimens, subsequent to exposure in a stress-corrosion environment, is listed in table 3. The geometric means of the lives for each test condition are also listed. The geometric mean was obtained by taking the antilog of the mean of the logs of the number of cycles to failure. The geometric means of the lives for each test condition (i.e., exposure stress and exposure time) are plotted in figures 3 to 6.

p. 5

The results of these fatigue tests indicate that the stresses applied to the specimens during atmospheric exposure and prior to fatigue testing had no significant effect on the fatigue life (figs. 3 to 6). Furthermore, most of the reduction in fatigue life due to atmospheric exposure occurred during the first year of exposure. The fatigue lives of the 7075-T6 and 2024-T3 specimens in the bare condition were shortened by factors of 4 and 3.5, respectively, while the life of the 7075-T6 material in the clad condition was shortened by a factor of 1.5. No factor could be determined for the 2024-T3 material in the clad condition due to the scatter of the test results. (See fig. 4.) It is clear from the data for the 7075-T6 clad material that the protective effect of the cladding did not make this material immune to corrosive attack.

The data for the 2024-T3 and 7075-T6 aluminum alloys in the bare condition show very little scatter whereas the same alloys in the clad condition show considerable scatter. (See table 3.) The scatter in the clad materials may be due to erratic corrosive attack at the edges of the specimens and in the holes where there is no cladding to protect the surface. There appears to be more scatter in the data for 2024-T3 clad material than in the data for the 7075-T6 clad material. The shaded symbols in figures 3 to 6 represent the lives of individual specimens that did not fail. These data were not used in obtaining the geometric means of the lives of these materials.

Identical tests conducted on unstressed and unexposed specimens in both the present investigation and in the investigation reported in reference 1 resulted in significantly different fatigue lives even though the same lot of material was used in both investigations. The only difference between these tests is the 5-year period of time between the investigations during which the specimens in the present investigation were stored indoors, unprotected and unstressed. The ratios of the geometric mean lives of the unexposed specimens in the present investigation to the geometric mean lives of the unexposed specimens in reference 1 are as follows:

2024-T3 bare - 0.67
2024-T3 clad - 2.84
7075-T6 bare - 1.19
7075-T6 clad - 1.79

The 2024-T3 bare material was the only one showing a decrease in life over that obtained in reference 1. The remaining three materials all showed an increase in life with the clad materials having the greatest increase. Two possible explanations for this behavior can be cited. For the bare material, the buildup of an oxide coating may result in a change in fatigue strength. For the clad materials, the diffusion of the core material into the clad material could increase the strength of the cladding and thus increase the fatigue strength. However, no conclusive evidence is available to explain the observed behavior.

Prior to fatigue testing, all specimens were checked for stress-corrosion cracking with a 30-power microscope. Corrosion of both the upper and lower surfaces was noticeable but no cracks were observed on the unclean surfaces.

Approximately the same reduction in fatigue life was found in the present investigation as was found in reference 1, in which the exposure times were much shorter. One possible explanation is that there is a faster rate of corrosive action for fatigue tests. An aluminum-oxide film develops on the surface of the specimens when they are exposed to the atmosphere, and this film partially protects the specimens from corrosive action. In the investigation of reference 1 this oxide film was repeatedly being broken by the fatigue loading and new material was being exposed continually to the atmosphere and thus afforded continuous corrosive action. However, in the present study the loading was held constant during exposure and consequently the corrosive action decreased with time. This decrease in corrosion rate with time probably explains why most of the decrease in fatigue life occurred during the first year of exposure.

CONCLUDING REMARKS

Fatigue tests were conducted on 300 vibrating cantilever sheet bending specimens after they were subjected to a combination of atmospheric corrosion and constant stress for varying periods of time up to 4 years. Specimens of 2024-T3 and 7075-T6 aluminum alloy in both the bare and clad forms were tested. For comparison, companion fatigue tests were conducted on identical specimens stored indoors. From the data presented, the following conclusions are made:

1. The fatigue lives of the 2024-T3 and 7075-T6 bare materials exposed to the atmosphere for 1 year or longer were approximately one-fourth of the fatigue lives of the same unexposed materials. Only a small reduction in fatigue life was noted for the 7075-T6 clad material, and essentially no reduction in life was noted for the 2024-T3 clad material after exposure times of 1 year or longer. The reduction in life for the clad materials was not as clearly defined as for the bare materials due to the large amount of scatter obtained in the data for the clad materials.

2. Most of the reduction in fatigue life, due to atmospheric exposure, occurred during the first year.

3. Constant stresses of 0, 12, and 30 ksi $\left(0, 83, \text{ and } 206 \text{ MN/m}^2\right)$ applied to the specimens during their exposure to the atmosphere appeared to have no significant effect on the fatigue life.

Langley Research Center,
National Aeronautics and Space Administration,
Langley Station, Hampton, Va., March 26, 1964.

APPENDIX

CONVERSION OF U.S. CUSTOMARY UNITS TO SI UNITS

The International System of Units (SI) was adopted by the Eleventh General Conference on Weights and Measures, Paris, October 1960, in Resolution No. 12 (ref. 2). Conversion factors required for units used herein are:

Length: Inches $\times$ 0.0254 = Meters (m)

Stress: Kips per square inch $\times$ 6.894757×10^6 = Newtons per square meter (N/m^2)

Frequency: Cycles per second = Hertz (Hz)

Temperature: $5/9\ (^{\circ}F + 459.67) = {}^{\circ}K$

Prefixes to indicate multiples of units are:

10^6 mega (M)

10^{-2} centi (c)

10^{-3} milli (m)

10^{-6} micro (μ)

REFERENCES

1. Leybold, Herbert A., Hardrath, Herbert F., and Moore, Robert L.: An Investigation of the Effects of Atmospheric Corrosion on the Fatigue Life of Aluminum Alloys. NACA TN 4331, 1958.

2. Anon.: Comptes Rendus des Séances de la Onzième Conférence Générale des Poids et Mesures. (Paris), Bur. Int. des Poids et Mesures, October 11-20, 1960.

3. Peterson, R. E.: Stress Concentration Design Factors. John Wiley & Sons, Inc., c.1953.

4. Foster, Lee R., Jr., and Stein, Bland A.: Tensile Properties and Sheet-Bending Fatigue Properties of Some Refractory Metals at Room Temperature. NASA TN D-1592, 1963.

TABLE 1.- AVERAGE TENSILE PROPERTIES OF 2024-T3 AND 7075-T6 ALUMINUM ALLOYS

Material	Yield strength, 0.2-percent offset		Ultimate tensile strength		Elongation, percent 2-inch (50.8-mm) gage length	Modulus of elasticity		Number of specimens
	ksi	MN/m^2	ksi	MN/m^2		ksi	MN/m^2	
2024-T3 bare	55.8	384	72.3	498	16.5	10.53×10^3	72.6	5
2024-T3 clad	50.7	349	66.7	460	16.0	9.51	65.5	3
7075-T6 bare	79.3	546	85.9	591	11.3	10.36	71.4	3
7075-T6 clad	66.6	459	73.8	508	10.9	9.71	67.0	4

TABLE 2.- AVERAGE METEOROLOGICAL DATA FOR TEST PERIOD

Month and year	Average temperature		Total precipitation		Days of precipitation	Days of thunderstorms	Snow		Days of snow
	°F	°K	in.	cm			in.	cm	
Jan. 1959	39	277	1.97	5.0	12	1	1.0	2.54	2
Feb.	43	279	1.91	4.85	13	0			
Mar.	49	283	4.06	10.31	19	2	T*	T	1
Apr.	59	288	5.68	14.42	18	3			
May	70	294	1.04	2.64	14	4			
June	76	298	1.55	3.94	9	4			
July	78	299	10.90	27.70	23	10			
Aug.	80	300	.83	2.11	16	4			
Sept.	74	297	5.62	14.30	9	5			
Oct.	65	292	7.50	19.08	19	5			
Nov.	51	284	2.34	5.94	15	1	T	T	1
Dec.	45	280	2.44	6.20	11	1	T	T	1
Jan. 1960	42	279	3.64	9.25	15	1	T	T	3
Feb.	42	279	2.70	6.85	12	0	5.7	14.49	2
Mar.	39	277	3.45	8.76	14	0	10.5	26.65	7
Apr.	63	290	1.51	3.84	8	1			
May	67	293	5.34	13.58	15	10			
June	75	297	2.42	6.15	14	6			
July	77	298	5.12	13.01	11	5			
Aug.	78	299	9.19	23.35	22	13			
Sept.	72	296	4.59	11.68	12	3			
Oct.	60	289	2.93	7.44	15	0			
Nov.	50	283	.72	1.83	12	1			
Dec.	35	275	1.98	5.03	8	1	T	T	2
Jan. 1961	34	274	3.15	8.00	11	1	3.8	9.65	7
Feb.	42	279	4.90	12.46	16	1	3.1	7.87	4
Mar.	51	284	4.30	10.92	17	3			
Apr.	54	285	1.84	4.67	18	3			
May	63	290	8.20	20.82	16	9			
June	72	296	5.10	12.98	17	8			
July	78	299	1.23	3.12	14	13			
Aug.	76	298	4.84	12.30	14	5			
Sept.	74	296	1.73	4.39	9	2			
Oct.	60	289	5.43	13.71	9	2			
Nov.	52	284	1.44	3.66	12	0	T	T	1
Dec.	41	278	4.39	11.17	13	1	T	T	1
Jan. 1962	38	276	4.21	10.70	18	0	15.1	38.37	8
Feb.	41	278	2.66	6.75	19	2	1.0	2.54	4
Mar.	45	280	3.39	8.61	13	2	4.5	11.42	3
Apr.	56	286	3.20	8.13	13	6	T	T	1
May	68	293	2.38	6.04	15	7			
June	72	296	5.95	15.11	15	6			
July	74	297	9.55	24.25	16	8			
Aug.	74	297	3.39	8.61	11	6			
Sept.	68	293	4.35	11.07	12	2			
Oct.	61	289	5.08	12.90	9	1			
Nov.	48	282	4.81	12.22	15	1	T	T	1
Dec.	36	276	2.84	7.21	14	0	7.6	19.31	8

*T - trace of snow, not measurable.

ae 56814 CARD 5/5

TABLE 3.- FATIGUE LIVES OF INDIVIDUAL SPECIMENS IN THOUSANDS OF CYCLES

[Leaders indicate unusable data]

Exposure stress	Zero					12 ksi (83 MN/m^2)					30 ksi (206 MN/m^2)					Zero
Exposure time, years	$\frac{1}{2}$	1	2	3	4	$\frac{1}{2}$	1	2	3	4	$\frac{1}{2}$	1	2	3	4	*Zero
2024-T3 bare at stress of 12 ± 25 ksi (83 ± 172 MN/m^2)	98×10^3	117×10^3	85×10^3	67×10^3	57×10^3	95×10^3	84×10^3	90×10^3	32×10^3	81×10^3	94×10^3	69×10^3	67×10^3	51×10^3	49×10^3	172×10^3
	115	124	97	72	80	96	84	94	88	90	98	84	71	60	66	229
	136	128	99	78	94	99	95	99	89	91	107	85	75	72	74	248
	159	151	100	80	115	131	100	107	98	96	143	94	94	76	79	265
	200	161	110	89	122	133	----------	118	----------	98	186	95	95	104	82	543
Geometric mean	137.3	135.2	97.9	76.8	90.3	109.5	[a]90.5	101.1	[a]70.9	91.0	121.2	84.9	79.6	70.5	68.9	269.0
2024-T3 clad at stress of 12 ± 15 ksi (83 ± 103 MN/m^2)	106×10^3	2195×10^3	780×10^3	563×10^3	1407×10^3	738×10^3	417×10^3	639×10^3	620×10^3	497×10^3	745×10^3	983×10^3	489×10^3	761×10^3	665×10^3	737×10^3
	457	3408	823	948	4017	836	1369	1070	1408	781	818	1257	572	882	1209	1152
	--------	3598	874	1063	4308	873	1560	1138	2345	1103	1676	4333	907	3620	1371	1399
	--------	--------	1186	1439	[b]32118	--------	[b]5664	1604	23345	1270	--------	16960	1338	11479	1650	1814
	--------	--------	1399	2270	[b]55675	--------	[b]21247	3219	25872	1399	--------	--------	3272	11673	3157	4019
Geometric mean	[c]220.1	[d]2997.0	985.4	1131.0	[d]2898.0	[d]813.6	[d]962.1	1321.0	4154.0	946.8	[d]1007.0	[a]3087.0	1021.0	3181.0	1418.0	1540.0
7075-T6 bare at stress of 12 ± 25 ksi (83 ± 172 MN/m^2)	69×10^3	71×10^3	58×10^3	46×10^3	56×10^3	63×10^3	60×10^3	51×10^3	50×10^3	47×10^3	68×10^3	66×10^3	59×10^3	--------	39×10^3	121×10^3
	70	73	60	47	57	67	60	55	52	54	88	69	61	--------	58	146
	78	74	63	54	60	78	63	60	53	55	91	78	67	--------	62	236
	86	82	64	54	65	90	65	60	62	62	93	85	73	--------	68	459
	123	84	64	65	67	100	69	61	66	62	94	99	86	--------	79	522
Geometric mean	83.2	76.6	61.8	52.8	60.8	78.4	63.3	57.3	56.3	55.5	86.2	78.5	68.6	--------	59.6	251.0
7075-T6 clad at stress of 12 ± 14.5 ksi (83 ± 100 MN/m^2)	287×10^3	495×10^3	401×10^3	355×10^3	263×10^3	272×10^3	385×10^3	401×10^3	2348×10^3	394×10^3	339×10^3	370×10^3	350×10^3	343×10^3	335×10^3	645×10^3
	505	545	407	401	433	413	451	438	20091	398	411	374	422	809	519	650
	522	655	430	530	546	421	480	449	25815	404	412	428	468	1368	991	661
	556	808	931	539	769	482	480	862	[b]33879	541	531	513	614	1663	[b]9574	764
	786	3915	--------	553	[b]36200	521	570	1826	[b]65522	857	--------	520	699	2552	[b]18135	1041
Geometric mean	505.7	890.2	[a]505.6	468.2	[a]467.6	412.0	469.5	658.8	[d]10680.0	493.8	[a]417.8	436.2	494.8	1100.0	[d]556.0	739.0

[a]Did not fail.
[b]Geometric mean of 2 tests.
[c]Geometric mean of 3 tests.
[d]Geometric mean of 4 tests.
*Stored indoors unprotected for 4 years before fatigue testing.

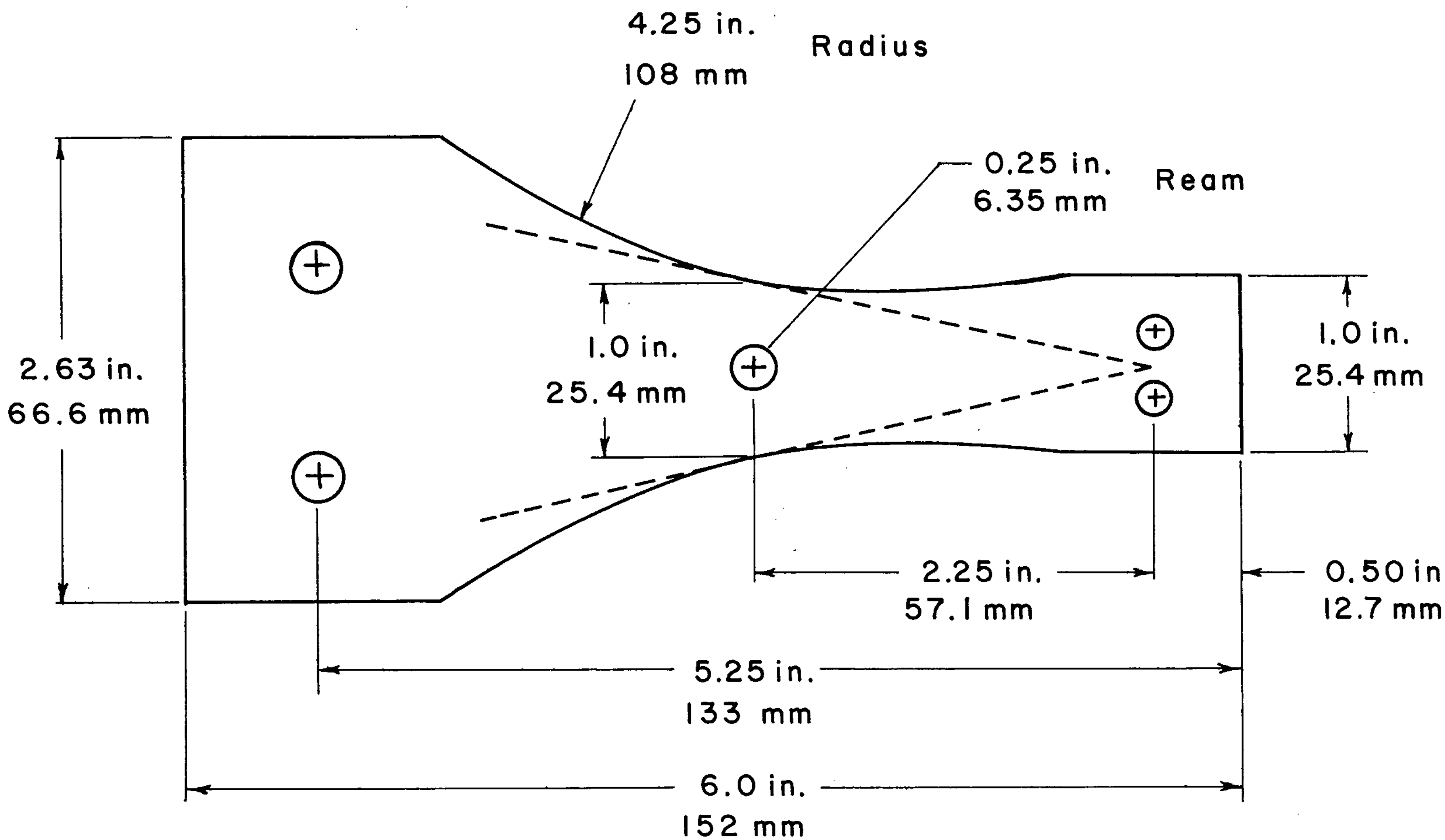

Figure 1.- Specimen configuration.

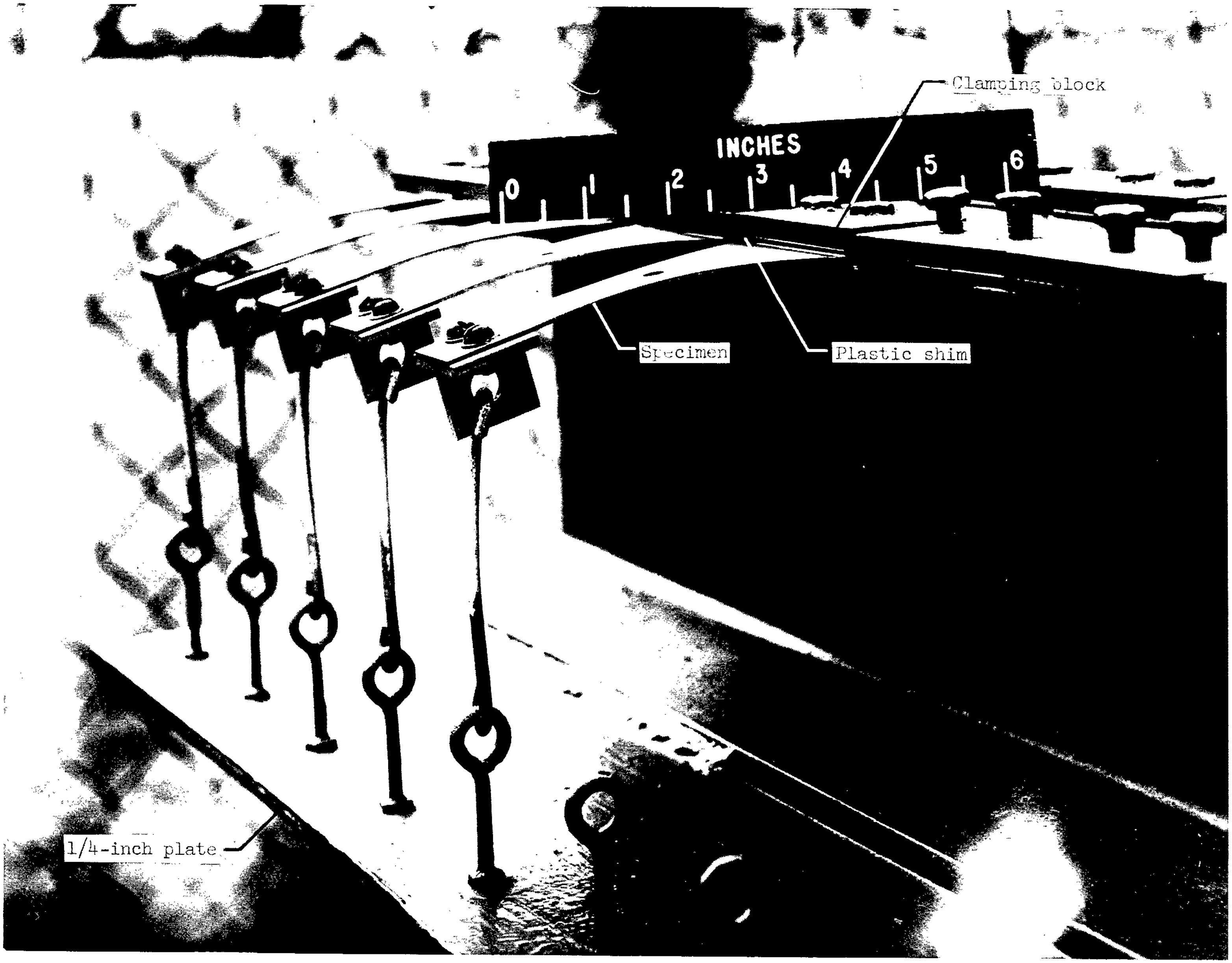

Figure 2.- Stressed specimens during corrosion portion of investigation. L-63-6558.2

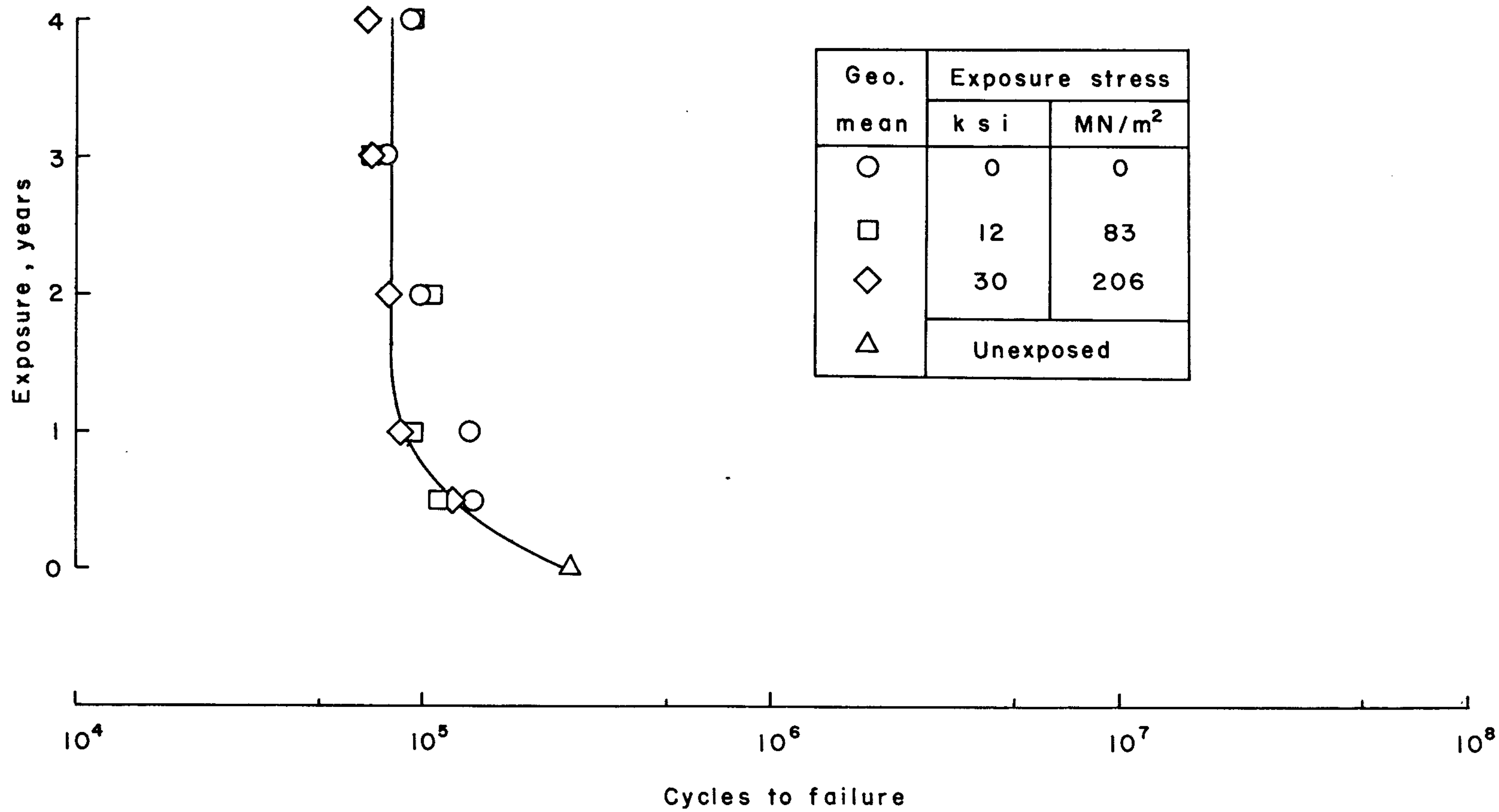

Figure 3.- Geometric means of fatigue lives for 2024-T3 bare aluminum-alloy specimens at various exposure times and stresses.

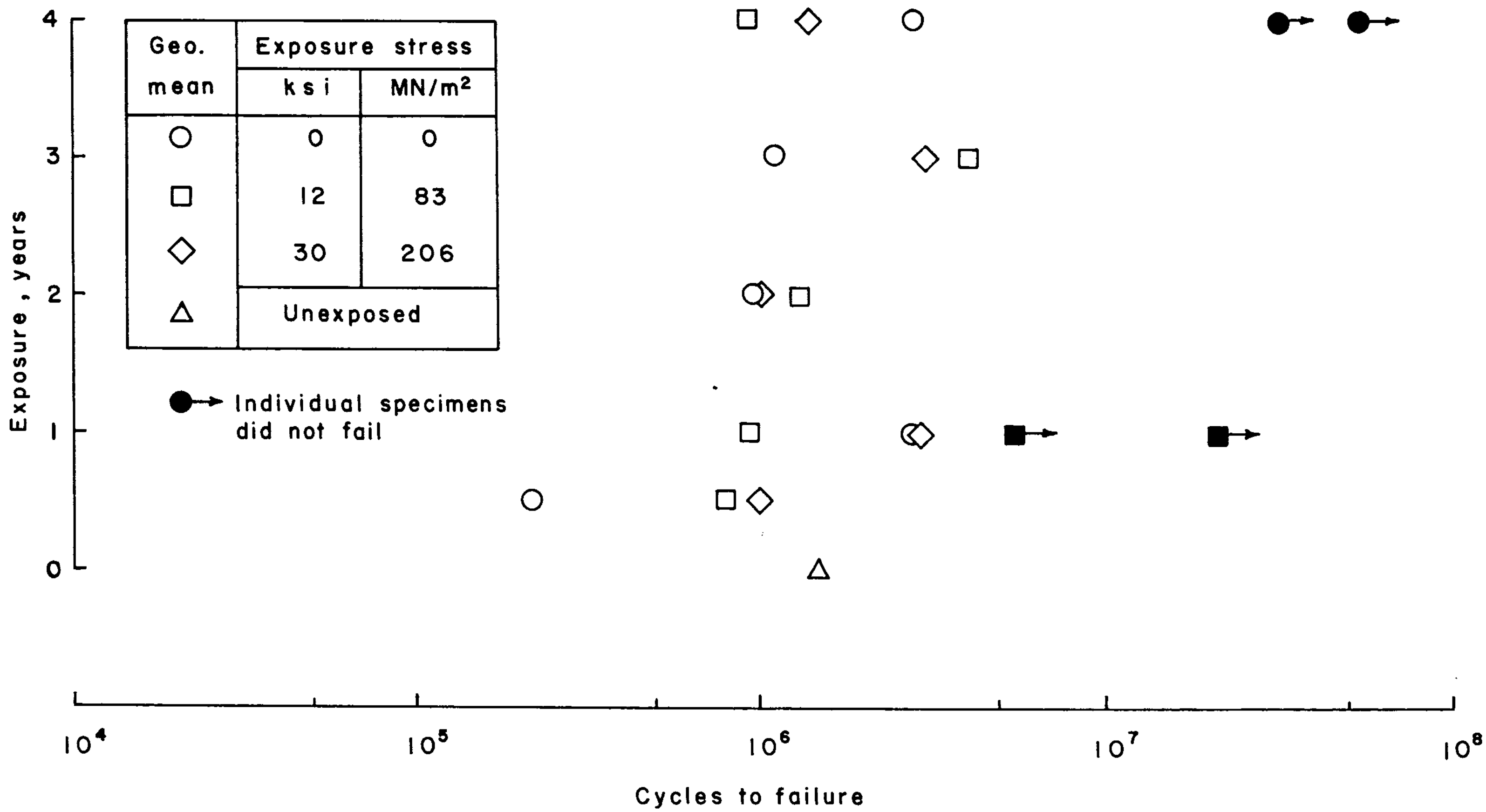

Figure 4.- Geometric means of fatigue lives for 2024-T3 clad aluminum-alloy specimens at various exposure times and stresses.

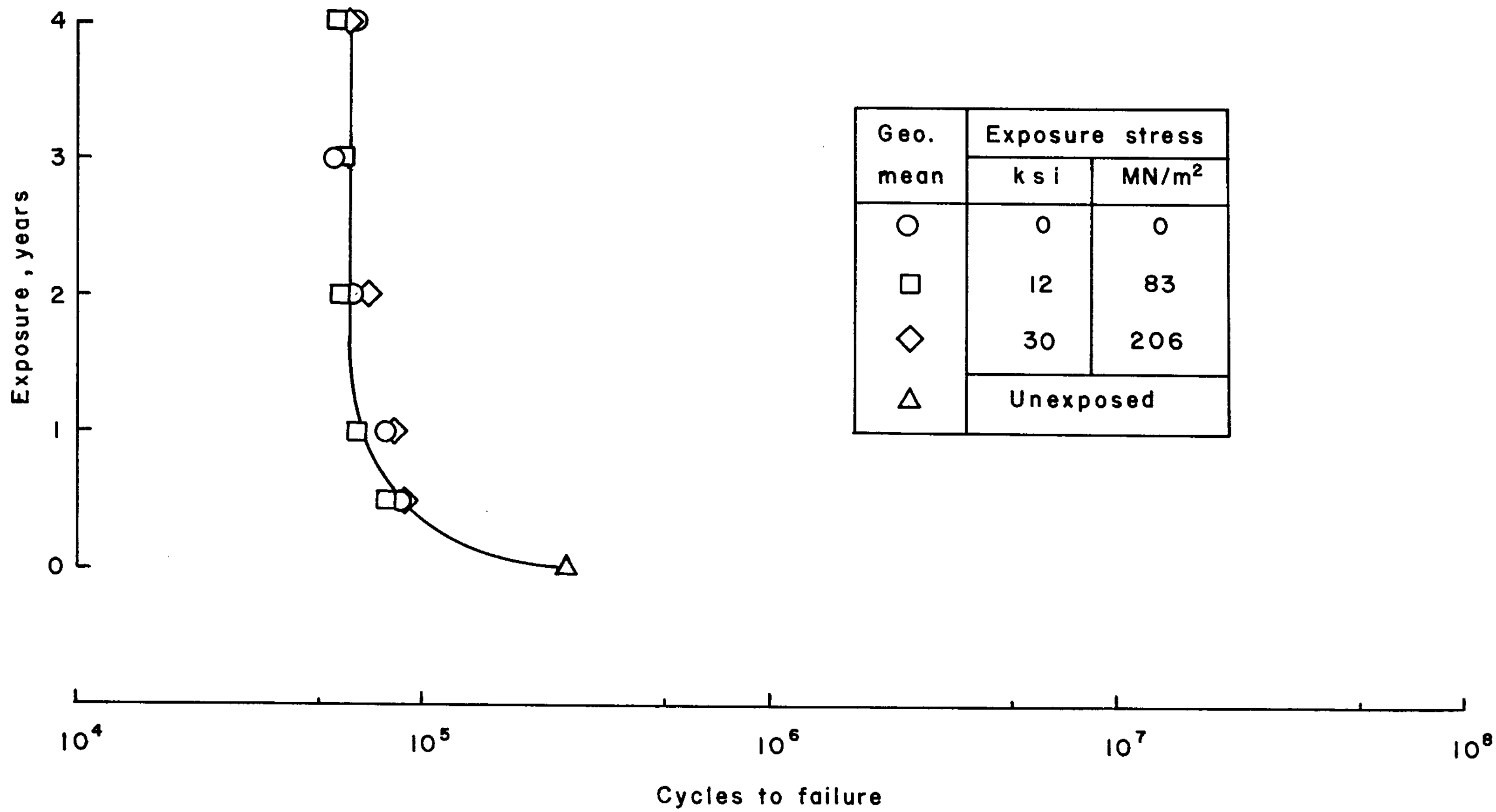

Figure 5.- Geometric means of fatigue lives for 7075-T6 bare aluminum-alloy specimens at various exposure times and stresses.

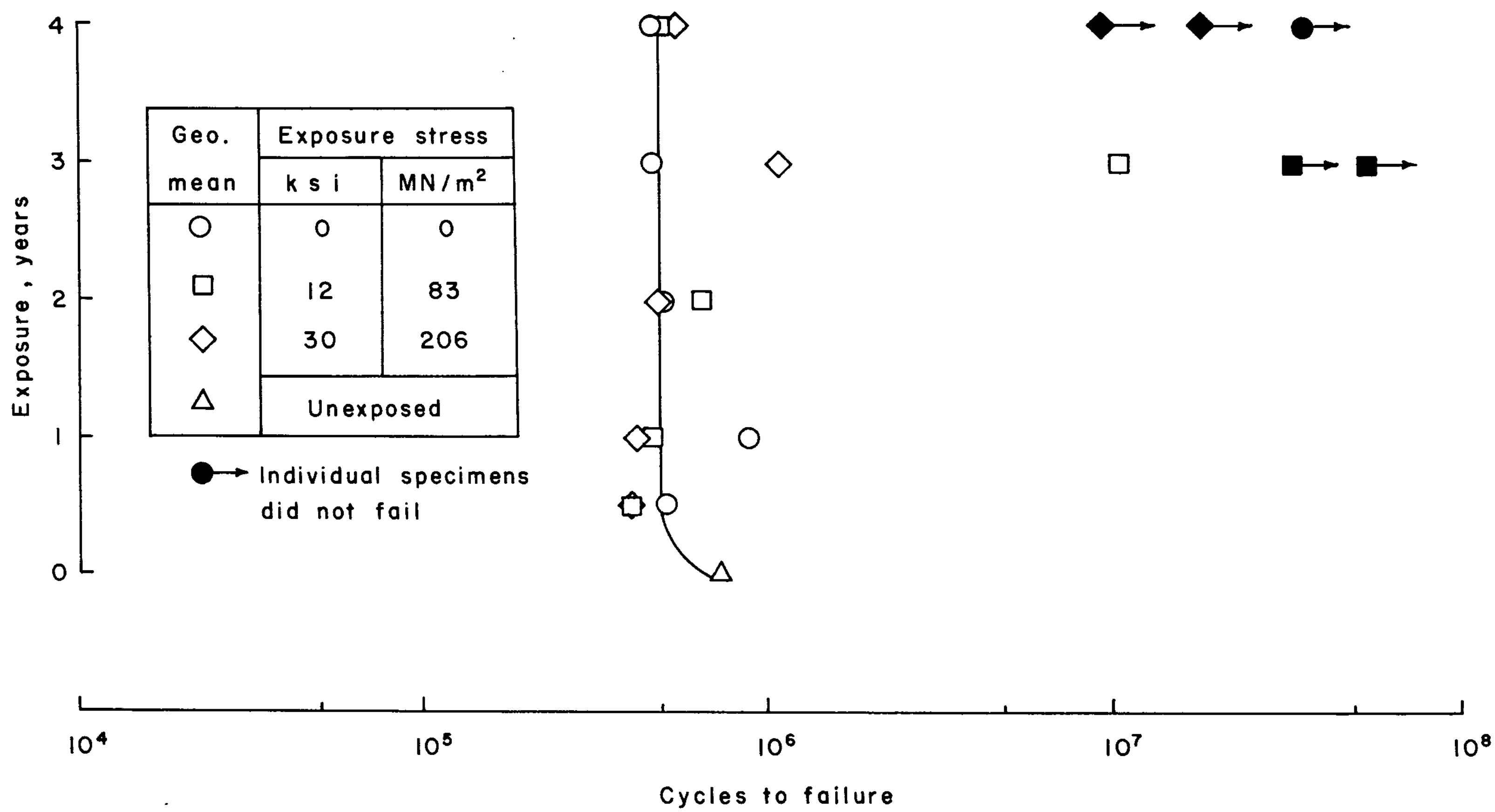

Figure 6.- Geometric means of fatigue lives for 7075-T6 clad aluminum-alloy specimens at various exposure times and stresses.

NASA-Langley, 1964 L-3947

NASA TN D-2359
National Aeronautics and Space Administration.
THE EFFECTS OF COMBINED PRIOR STRESS AND ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS. Herbert A. Leybold. August 1964. 16p. OTS price, $0.50. (NASA TECHNICAL NOTE D-2359)

Fatigue tests were conducted on 300 vibrating cantilever sheet bending specimens after the specimens were subjected to atmospheric stress corrosion for varying periods of time up to 4 years. Specimens of 2024-T3 and 7075-T6 aluminum alloy in both the bare and clad forms were tested. For comparison, companion tests were conducted indoors. The results indicate that the constant stresses applied to the specimens during the stress-corrosion portion of the investigation had no significant effect on the fatigue life. Most of the reduction in fatigue life due to atmospheric exposure occurred during the first year.

I. Leybold, Herbert A.
II. NASA TN D-2359

NASA

NASA TN D-2359
National Aeronautics and Space Administration.
THE EFFECTS OF COMBINED PRIOR STRESS AND ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS. Herbert A. Leybold. August 1964. 16p. OTS price, $0.50. (NASA TECHNICAL NOTE D-2359)

Fatigue tests were conducted on 300 vibrating cantilever sheet bending specimens after the specimens were subjected to atmospheric stress corrosion for varying periods of time up to 4 years. Specimens of 2024-T3 and 7075-T6 aluminum alloy in both the bare and clad forms were tested. For comparison, companion tests were conducted indoors. The results indicate that the constant stresses applied to the specimens during the stress-corrosion portion of the investigation had no significant effect on the fatigue life. Most of the reduction in fatigue life due to atmospheric exposure occurred during the first year.

I. Leybold, Herbert A.
II. NASA TN D-2359

NASA

NASA TN D-2359
National Aeronautics and Space Administration.
THE EFFECTS OF COMBINED PRIOR STRESS AND ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS. Herbert A. Leybold. August 1964. 16p. OTS price, $0.50. (NASA TECHNICAL NOTE D-2359)

Fatigue tests were conducted on 300 vibrating cantilever sheet bending specimens after the specimens were subjected to atmospheric stress corrosion for varying periods of time up to 4 years. Specimens of 2024-T3 and 7075-T6 aluminum alloy in both the bare and clad forms were tested. For comparison, companion tests were conducted indoors. The results indicate that the constant stresses applied to the specimens during the stress-corrosion portion of the investigation had no significant effect on the fatigue life. Most of the reduction in fatigue life due to atmospheric exposure occurred during the first year.

I. Leybold, Herbert A.
II. NASA TN D-2359

NASA

NASA TN D-2359
National Aeronautics and Space Administration.
THE EFFECTS OF COMBINED PRIOR STRESS AND ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS. Herbert A. Leybold. August 1964. 16p. OTS price, $0.50. (NASA TECHNICAL NOTE D-2359)

Fatigue tests were conducted on 300 vibrating cantilever sheet bending specimens after the specimens were subjected to atmospheric stress corrosion for varying periods of time up to 4 years. Specimens of 2024-T3 and 7075-T6 aluminum alloy in both the bare and clad forms were tested. For comparison, companion tests were conducted indoors. The results indicate that the constant stresses applied to the specimens during the stress-corrosion portion of the investigation had no significant effect on the fatigue life. Most of the reduction in fatigue life due to atmospheric exposure occurred during the first year.

I. Leybold, Herbert A.
II. NASA TN D-2359

NASA

"The aeronautical and space activities of the United States shall be conducted so as to contribute . . . to the expansion of human knowledge of phenomena in the atmosphere and space. The Administration shall provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."

—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

NASA SCIENTIFIC AND TECHNICAL PUBLICATIONS

TECHNICAL REPORTS: Scientific and technical information considered important, complete, and a lasting contribution to existing knowledge.

TECHNICAL NOTES: Information less broad in scope but nevertheless of importance as a contribution to existing knowledge.

TECHNICAL MEMORANDUMS: Information receiving limited distribution because of preliminary data, security classification, or other reasons.

CONTRACTOR REPORTS: Technical information generated in connection with a NASA contract or grant and released under NASA auspices.

TECHNICAL TRANSLATIONS: Information published in a foreign language considered to merit NASA distribution in English.

TECHNICAL REPRINTS: Information derived from NASA activities and initially published in the form of journal articles.

SPECIAL PUBLICATIONS: Information derived from or of value to NASA activities but not necessarily reporting the results of individual NASA-programmed scientific efforts. Publications include conference proceedings, monographs, data compilations, handbooks, sourcebooks, and special bibliographies.

Details on the availability of these publications may be obtained from:

SCIENTIFIC AND TECHNICAL INFORMATION DIVISION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Washington, D.C. 20546